THE ADEQUACY OF DIETS OF 38 HONOLULU FAMILIES ON RELIEF

AND SUGGESTIONS FOR OBTAINING A MORE ADEQUATE DIET ON A LIMITED BUDGET

BY MARTHA POTGIETER, ASSOCIATE NUTRITIONIST
HAWAII AGRICULTURAL EXPERIMENT STATION
1935-42

HAWAII AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF HAWAII, BULLETIN NUMBER 94, JUNE 1944

ACKNOWLEDGMENTS

Grateful acknowledgment is made for the kind cooperation and assistance of the following:

Mr. John Wilson, Director, Department of Public Welfare, Territory of Hawaii; Mrs. Clorinda L. Lucas,[1] Agent, Oahu Division of Department of Public Welfare, and her staff of social case workers; the families who cooperated in the study; U. S. Works Projects Administration and the five W. P. A. workers who collected and calculated the data; Miss Helen M. Baukin, Supervisor of the Division of Dental Hygiene, and her staff, Department of Public Instruction, Territory of Hawaii; Strong-Carter Dental Clinic for Children at Palama Settlement, Honolulu; Adult Dental Clinic at Palama Settlement, Honolulu; H. Dorothy Dudley, D.D.S., Honolulu; Professor Carey D. Miller, Head of Nutrition Department, Hawaii Agricultural Experiment Station.

Toyo Takase Kimura and Ellen Yokoyama, of the Hawaii Agricultural Experiment Station staff, rendered technical assistance to the author in the preparation of this study.

[1] Now Director of Pupil Guidance, Department of Public Instruction, Territory of Hawaii.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFATORY NOTE

Since the writing of this bulletin in July 1941, the war has produced many changes in Hawaii's food supply—a rise in food prices, a reduction in the normal imports of foods from the United States mainland and foreign countries, and decreases in some lines of local food production and increases in others. Some of these changes will make it more difficult for families on relief and other families with low incomes to obtain an adequate diet.

For information about the best way of obtaining an adequate diet at minimum or moderate cost under present emergency conditions, readers of this bulletin are referred to the Department of Public Welfare, Territory of Hawaii; the nutritionist, Board of Health, Territory of Hawaii; the University of Hawaii Cooperative Extension Service in Agriculture and Home Economics; the Department of Home Economics of the University of Hawaii; and the Nutrition Department of the Hawaii Agricultural Experiment Station.

FOREWORD

Good quality in the food we eat is as important for health and well-being as an adequate quantity of food. The nutritive quality of food is determined by its chemical constituents and not merely by taste, which alone guides many people in their food selection. Unfortunately, foods deficient in minerals and vitamins may taste as good as those that supply generous quantities of these important nutrients.

Spending a large amount of money for food does not guarantee an adequate diet. Families may spend enough money for food and may feel psychologically satisfied by their diets and yet be inadequately nourished because of an unwise selection of food. However, a limited food budget is more likely to result in a nutritionally inadequate family diet than a generous budget. When the money for the family food is barely adequate, it is very important that each food dollar be spent wisely—that only foods of relatively high nutritive value should be chosen. In order to do this, some knowledge of food values and food needs is required.

Public health officials and others throughout the United States are today emphasizing the fundamental importance of adequate nutrition in maintaining health. Good health is impossible without proper food, and the practical problem of educating people to better food habits must be shared by all those in a position to aid in the government's program of building a healthier America with better food. The social worker who deals intimately with families receiving financial aid from the government has an unusual opportunity to teach some simple facts about good nutrition and to guide families in wise buying.

Before attempting to guide a group of low-income families in the wise expenditure of their food money, it is desirable to know something of their food-buying habits and their food likes and dislikes. For this purpose a study was made of the food-consumption habits and the nutritive adequacy of the diets of a number of relief families in Honolulu, Hawaii, between the months of June and December 1940.

At the time this study was made, there were about 850 families with children in the City and County of Honolulu receiving aid from the Department of Public Welfare. Official records make no segregation of city and rural cases. With the aid of the social caseworkers, 65 city families with children were chosen for the study. Caseworkers were asked to recommend families that were willing to cooperate and that were able to understand the purpose of the study and to keep records. In the selection preference was given to families (1) which had several children, (2) which had been on relief a long

time, (3) which were on full relief, rather than supplementary relief, and (4) which had no immediate, or only minor, health problems. Only 38 of the 65 families completed the records; however, this number is believed to be an adequate sample to illustrate the food consumption habits of *families on relief*. In fact, it is unlikely that those who through indifference or for other reasons failed to complete the study were enjoying better selected food than those whose records are presented here.

Section I of this bulletin reports the procedure and the findings of this survey. Stated briefly, the study shows that most of the 38 cooperating families were living on seriously deficient diets. More than half (58%) of the family diets were deficient in 7 or 8 food constituents necessary for optimum growth, health, and working capacity. The total money value of the family diets was on the average 5 percent above the amount required for a minimum-cost adequate diet in Honolulu at the time of the study. About half of the families were not spending enough money to secure nutritionally adequate diets, although all their grants made allowance for adequate food budgets. In general, the families spending more money per capita for food had more nearly adequate diets than those families spending less. *However, not one of these family diets, purchased with more than adequate food budgets, was completely adequate nutritionally.* If these food budgets had been managed with an understanding of nutritional needs and food values, they could have provided adequate diets.

Section II points out some errors in food purchasing made by these 38 families and gives some suggestions for obtaining a more adequate family diet on a restricted food budget.

This report is part of a larger study of the adequacy of family diets of various racial groups in Hawaii. It is offered in the belief that it will give concrete evidence of the need for education in food buying and nutritional guidance of low income families, and will illustrate the type of changes that should be made in the diets.

SECTION I. PROCEDURE AND FINDINGS

1. Selection of Families for This Study

From the relief rolls of Honolulu, 65 families were selected on the basis of number of children in the family, length of time on relief, and amount of assistance received. Preference was given to families with many children, to those on relief for a long period of time, and to those on full relief rather than on supplementary relief. Families with no immediate or with only minor health problems in the home were chosen. The selection was made without regard to racial or national origin. Practically all racial groups residing in Hawaii are represented in the study.

The families were interviewed in their homes and were asked to keep a record of all foods consumed over a period of four weeks. Many of the 65 families were unable to cooperate in the study because the mother was working outside the home. Some of the mothers were not interested and did not wish to cooperate. Forty-three families were able and willing to keep the food records. The majority of these families were sincerely interested in learning more about nutrition. Thirty-eight of them completed the records in compliance with the instructions given. The status of these 38 families in regard to family composition, length of time on relief, reasons for being on relief, and health conditions, is found in tables 1 to 4, inclusive (pp. 10 and 11).

2. Collection of Family Food Data

(*a*) *Family visits.* All home visits were made, and all family records of food consumption were collected and checked with the family, by three W. P. A. assistants, all of whom were recent graduates of the University of Hawaii in social work. All three had had some experience in social case work in Honolulu, as student field workers or as volunteer workers with the Territorial Department of Public Welfare. Each cooperating family was visited one to three times a week during the 4-week period of the food study.

(*b*) *Family food records.* On the day the food study was begun, all food on hand in the home was weighed and recorded. At the end of the study this was done again. The two inventories were made 28 days apart and at approximately the same hour of the day. A few of the family food records were continued for a period of 29 or 30 instead of 28 days, but all data in these cases were reduced to a 28-day consumption period.

Table 1.—Composition of the 38 families

Number of families in which there was a father	9.0
Number of families in which there was a mother	36.0
Number of families in which there was a grandparent	1.0
Number of families having children	38.0
Average number of children per family (range: 2 to 7)	4.3
Average number of adults per family	1.2
Average size of family (range: 3 to 9)	5.5
Total number of individuals in all the families:	
Adults	46.0
Children (ranging in age from 6 months to 21 years)	164.0
Total individuals	210.0

The families were provided with blank forms on which to record during the 4-week period all foods brought into the home for family use—the kind, source, cost, and weight of each food. Scales were not used; the weight of the food, as stated by the merchant or vendor, was recorded. Home-grown foods and food gifts received were carefully described regarding quantity as well as quality. Space was provided on the forms for recording all meals and between-meal lunches served to guests in the home, for food given away, and for all meals and lunches eaten away from home by family members excepting lunches taken from home.

The family name never appeared on the records. Instead each family was given a number, which was placed at the top of each record sheet.

The cooperating families were asked to follow their customary food habits, so that the month's record of food consumption would be as nearly as possible representative of their usual diet.

(*c*) *Time of year.* Twenty of the family food records were made during the summer (June, July, August) and 18 in early winter (November, December). There is only a slight seasonal variation in Hawaii in the price of foods and in the kinds of vegetables and fruits on the market, as compared with most of the mainland United States. Family food habits and total food costs may be influenced somewhat by children being at home for vacation or attending school and buying school lunches.

The 4-week period of food records was so selected as not to include holidays or other events that would affect the routine food intake of the family to any considerable extent.

Table 2.—Length of time the 38 families have been on relief

Time[1]	Number of families
Less than 1 year	5
1 to 3 years	16
4 to 6 years	7
More than 6 years	10

[1] Average time on relief: 4.3 years. Range: 2 months to 12 years.

Table 3.—Reasons for being on relief

Reason		Number of families
General assistance		6
Aid to dependent children		32
Father deceased	13	
Father deserted	4	
Parents divorced	3	
Father in prison	1	
Father unable to work[1]	11	
Total		38

[1] Reasons given: tuberculosis, 5; leprosy, 2; hernia, 1; in indigent home, 1; too old to work, 1; vertigo, 1.

Table 4.—Health of the 38 families at the time of the food study

Number of families with no immediate health problems		19
Number of families with health problems		19
Health problems in these families:		
Condition		Number of cases[1]
Anemia		2
Asthma		1
Diabetes		2
Heart trouble		2
Hernia		1
Kidney disease		2
Lactation[2]		1
Leprosy (in absent family members, both fathers)		2
Recent surgical operation		1
Tuberculosis (in 10 families)		52
Active (living at home)	1	
Active (in Leahi Home)	5	
Arrested (living at home)	3	
Contact	42	
Suspect	1	
Venereal disease		1
Vertigo		1

[1] Total number of individuals in these families, living at home, with health problems was 59. One mother had three ailments—anemia, asthma, and recent surgical operation.
[2] A mother requires extra food during pregnancy and lactation for protection of her health.

3. Analysis of the Dietary Data—Cost, Composition, and Nutritive Adequacy of the 38 Family Diets

(*a*) *Money value of the family diets.* The amount (in pounds) and cost of each kind of food used in the 4-week period were calculated for each of the 38 families. Home-grown foods and foods received as gifts are listed at current retail prices.

Table 5 (p. 12) shows the total money value of each family's diet, sources of foods used, and adequacy (or inadequacy) of each family's food budget.

Table 5.—Money value of family diets and adequacy of food budgets

1	2	3	4	5	6	7	8	9
Family No.	No. in Family	Total money spent for food in 28 days	Value of home-grown foods	Value of food gifts received	Total money value of diet (28 days)	Food cost per capita per 28 days	Amount of money required for 28 days for a minimum adequate diet[1]	Percentage adequacy of the food budget
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Percent
M-1	8	34.06 2.55[2]	.....	1.89 4.18	38.50	4.81	50.39	—24
M-2	5	30.33	.....	3.72[3]	38.23	7.65	32.40	±18
M-3	5	30.80	.....	.54	31.34	6.27	34.64	—10
M-4	6	42.07	.....	1.17	43.24	7.21	36.52	+18
M-5	6	33.68	.....	1.08	34.76	5.79	34.53	+ 1
M-6	8	38.41	.....	.16	38.57	4.82	51.26	—25
M-8	3	23.08 4.95[2]	.....	.69 .20	28.72	9.57	25.82	+11
M-9	6	35.18	.....	4.41[3]	39.79	6.63	41.37	— 4
M-10	5	30.54	.....	1.21	31.75	6.35	33.36	— 5
M-11	3	18.79	.....	1.34	20.13	6.71	23.14	—13
M-12	7	36.22	.....	.67 5.69	36.89	5.27	40.04	— 8
M-13	6	27.60	2.40	2.55[3]	38.24	6.37	41.68	— 8
M-14	3	19.09	.....	.46	19.55	6.52	17.30	+13
M-15	3	21.00 1.27[2]	.....	7.43 .80[3]	30.50	10.17	21.01	+44
M-16	8	43.07 3.10[2]	.....	5.73	51.90	6.49	51.98	± 0
N-1	4	26.80 2.55[2]	.....	2.86	32.21	8.05	32.09	± 0
N-2	5	38.10 .80[2]	.....	.....	38.90	7.78	40.00	— 3
N-3	7	37.12 .60[2]	.....	5.70 4.25	43.42	6.20	45.36	— 4
N-4	5[4]	47.03	5.61	.50[3]	57.39	11.48	39.30[5]	+46
N-5	5	28.11	.....	1.34	29.45	5.89	30.00	— 2
O-1	5	30.48 2.70[2]	.....	.31 2.70[3]	36.19	7.24	39.48	— 8
O-2	3	17.60	.....	.47	18.07	6.02	22.00	—18
O-4	6	27.05	.....	.25	27.30	4.55	42.24	—35
O-8	5	27.75 8.60[2]	.....	4.02	40.37	8.07	38.28	+ 5
O-9	6	32.61 20.40[2]	.....	5.50 7.00[3]	65.51	10.92	42.32	+55
O-11	6	43.33 6.25[2]	.....	.06 3.00[3]	52.64	8.77	40.40	+30
O-15	3	17.45 1.90[2]	.....	.14	19.49	6.50	23.59	—17
O-16	5	20.98	.....	1.04 .47[3]	22.49	4.50	30.80	—27
O-18	9	44.35 2.78[2]	.....	.07	47.20	5.24	57.11	—17
		27.59		3.25				

Table 5.—Money value of family diets and adequacy of food budgets—Continued.

1	2	3	4	5	6	7	8	9
Family No.	No. in Family	Total money spent for food in 28 days	Value of home-grown foods	Value of food gifts received	Total money value of diet (28 days)	Food cost per capita per 28 days	Amount of money required for 28 days for a minimum adequate diet[1]	Percentage adequacy of the food budget
			Dollars	Dollars	Dollars	Dollars	Dollars	Percent
O-19	6	9.60[2] 40.34	.....	7.20[3]	47.64	7.94	39.24	+21
O-21	5	2.81[2] 46.42	.....	.25	43.40	8.68	39.08	+11
O-22	7	4.74[2] 84.37	.....	1.67	52.83	7.55	49.64	+ 6
O-24	8	7.56[2]	.....	2.70 .91	94.63	11.83	59.94	+58
O-26	3	21.93 48.49	.....	.20[3]	23.04	7.68	17.30	+33
O-27	6	12.80[2] 32.45	.....	.10	61.39	10.23	37.86	+62
O-28	6	6.30[2] 34.76	.....	.....	38.75	6.46	40.82	— 5
O-31	4	3.40[2] 48.03	.....	.....	38.16	9.54	38.65	— 1
O-32	9	4.80[2]	.....	.....	52.83	5.87	60.27	—12
Av.	5.5			2.63	39.62	7.31		+ 5
Range	3-9			.07-12.50		4.50-11.83		—35 to +62

[1] Based on minimum-adequate food allowances given in REPORT OF THE COMMITTEE ON A MINIMUM STANDARD OF LIVING AND ITS COST, Honolulu Council of Social Agencies, 1937 (12), the food budget of which was revised in August 1940. These family food budgets are calculated for the specific period of the food study—based on composition of each family (total number, and age, sex, occupation, and health of each member) and food prices for August 1940 in Honolulu. The budgets for 2 families of the same size may vary because of difference in ages of the children, number of adults in the family, health conditions, etc.

[2] Meals paid for away from home.

[3] Meals received free away from home.

[4] Exclusive of young infant grandchild in the home.

[5] Exclusive of the 4-weeks' allowance ($5.68) for young infant grandchild, who was not included in the food study.

(*b*) *Consumption of home-grown foods and of gifts of food.* Only 2 families out of the 38 produced any food at home during the food study. In one family this produce consisted of fruits worth $2.43 and eggs worth $3.18; in another family, it consisted of eggs worth $2.40. Eight other families had fruit trees that were not bearing at the time of the food study. Two other families kept a few chickens but were getting no eggs at the time of the study. One family had started a vegetable garden, but the vegetables were not yet ready for use. Twenty-seven families were not producing any foods at home. It was impossible for many of the families to have gardens, since there was no land available. However, more of the families could have reduced their food costs and added variety and nutritive value to their diets by producing food at home.

In table 5, column 5 ("Value of food gifts received") includes gifts of food brought to the family and consumed in the home, and "free" meals eaten

by family members, either at the home of friends or relatives, or at the place of employment as part payment for work. The value of each family's free meals away from home and gifts of food brought to the home are given separately in column 5.

(*c*) *Adequacy of the family food budgets.* From the last column in table 5 it will be seen that the food budgets (total money value of the diets) of these 38 families averaged 5 percent above the amount of money required to obtain a minimum cost adequate diet for these families at the time of the study. Sixteen (42 percent) of the families spent more money than necessary to obtain an adequate diet—an average of 26 percent more, with a range for the 16 families of plus 1 to plus 62 percent. Twenty families (53 percent) were spending too little money for food.

(*d*) *Amounts of various kinds of food used in the 28 days.* In table 6 (p. 15) are recorded the average amounts of various kinds of food used by the 38 families in the 28-day period. The percentage distribution of pounds of food consumed in these common food groups is one basis for evaluating the nutritive adequacy of diets. If too high a percentage of the total pounds of food consumed consists of refined cereals and sweets (foods low in minerals and vitamins), then the diet is inevitably deficient in minerals and vitamins. If the family diet is to be nutritionally adequate, the protective foods (vegetables, fruits, milk, whole-grain cereals, eggs, and organ and glandular meats) must predominate. As calculated from the pounds of various foods allowed per capita per year for an adequate diet at minimum cost (23),[1] 30 to 35 percent of the total weight of food consumed should consist of vegetables and fruits; about 40 percent should be milk and milk products; 15 to 18 percent, cereals and cereal products (and two-thirds or more of these should be whole-grain or unrefined); 6 percent, meat, fish, and eggs; and about 6 percent, fats and sweets. These 38 families consumed on the average too much refined cereal foods and meat, and too little whole-grain cereal foods and milk. The average total consumption of vegetables and fruits was adequate in amount, but these foods were not always wisely selected. The families used too few of the green leaf and yellow vegetables, legumes, tomatoes, yellow fruits, and citrus fruits (the plant foods richest in minerals and vitamins).

(*e*) *Amounts of money spent for various kinds of food.* Table 6 also shows the average total money value of the foods consumed by these families during the 28-day period and its percentage distribution among the various food groups. Nutrition authorities have calculated the approximate ideal percentage distribution of the food budget among the food groups. For an adequate diet at minimum cost for families with children, Stiebeling and Ward (23) recommend the following percentage distribution of food money: 20 to 25 percent for vegetables and fruits; 30 to 35 percent for milk and milk products; 15 percent for cereals and cereal products; 15 percent for meat, fish, and eggs; and 15 percent for fats, sweets, and miscellaneous foods. In comparison with the mainland standard, these families spent too little of their food money for milk and too much for cereals and meats. According to the recommendation of the Honolulu Council of Social Agencies, the distribution of the food money should be: 20 to 25 percent for vegetables and fruits; 15

[1] Numbers in parentheses refer to literature cited, page 37.

to 25 percent for milk and milk products; 20 to 30 percent for cereals and cereal products; 18 to 25 percent for meat, fish, eggs, and legumes and legume products; and 10 to 12 percent for fats, sweets, and miscellaneous foods. In comparison with this standard the expenditure for cereals by the 38 families was not excessive, but too little was spent for milk and too much for meat.

(*f*) *Average annual per capita consumption of various selected foods.* Table 7 (p. 16) shows the average annual per capita consumption of certain selected foods by these 38 families, calculated from their 28-day food records. These figures may be compared with the recommended annual per capita consumption of these foods for an adequate diet at minimum cost based on the figures of the Honolulu Council of Social Agencies (12) and the Bureau of Home Economics (23), which are also given in table 7. The recommendations

Table 6.—Average weight and cost of foods used per family in the 4-week period, and their percentage distribution among the common food groups

Food items	Vegetables	Fruits	Milk	Cereals		Meat, fish, eggs	Fats and oils	Sweets	Miscellaneous	Total
				Brown	White					
Pounds of food used[1]	77	50	49[2]	14	93	45	7.2	11.8	9.7	357
	127			107			29			
Percentage distribution by weight	36		14	30		12	8			
Recommended percentage distribution by weight (23)	30-35		40	15-18		6	6			
Money value of foods eaten at home[1]	$7.72		$4.27	$7.70		$12.06	$2.16	$1.20	$1.56	$36.67
							$4.92			
Percentage distribution of money	21		12	21		33	13			
Recommended percentage distribution of food money (23)	20-25		30-35	15		15	15			
Recommended percentage distribution of food money (12)	20-25		15-25	20-30		18-25[3]	10-12			

[1] Including home-grown foods and food gifts brought to the home; not including meals eaten away from home.
[2] Including milk purchased and consumed away from home, if any.
[3] Including legumes.

of Stiebeling and Ward are for average population groups composed of families with an average composition of about 2 adults and 3 children. For a group such as the one reported here (composed of families containing about 1 adult and 5 children each), the annual per capita consumption of the foods should be slightly different. The consumption of vegetables, fruits, and milk should be a little higher, and that of the energy foods a little lower, because of children's higher requirement for protective foods.

A comparison of the figures in table 7 shows again that the consumption of protective foods by these families was too low and that of cereal foods and meats too high. For an adequate diet a minimum of 50 percent (or better, two-thirds) of the cereal foods used should be unrefined. In these diets only 13 percent of the cereal foods were whole-grain. But this is a higher percent-

Table 7.—Average annual per capita consumption of selected foods by the 38 families

Foods	Average annual per capita consumption in pounds		
	By the 38 Honolulu families	Recommended by the Honolulu Council of Social Agencies (12)[1]	Recommended by Stiebeling and Ward (23)[2]
	Pounds	*Pounds*	*Pounds*	*Pounds*
Vegetables and fruits		299	485	430
Milk and milk products	116[3]			
Fresh whole milk equivalent of same		156	297	520[4]
Fresh milk	(73) 73			
Evaporated milk	40			
Fresh whole milk equivalent of same	80			
Other milk products	3[5]			
Fresh whole milk equivalent of same[5]	3			
Cereals (all cereal products)		254	188	224
Refined cereals	221			
Whole-grain cereals	33			
Rice, polished	140			
Rice, brown[6]	8			
Meat, fish, eggs		105	86	80
Fats (including butter, oils, bacon)		17	37	49
Sugar and other sweets		27	37	43

[1] Calculated from the allowances for a family of two adults and three children under ten.
[2] For an adequate diet at minimum cost.
[3] Including milk purchased and consumed away from home, if any.
[4] In terms of pounds of fresh whole milk.
[5] Consisting of ice cream, chiefly, and a small amount of cheese, both converted here into their fresh milk equivalent by multiplying by the appropriate factors.
[6] Used by only 2 of the 38 families.

age of unrefined cereal foods than was used by similar population groups in Hawaii a few decades ago.

The per capita consumption of evaporated milk is higher in this group,[2] and throughout most of Hawaii, than in the mainland United States,[3] where fresh milk is relatively cheaper. The average per capita consumption of fats is less in Hawaii than in the mainland United States, because of a warmer climate and of difference in food customs. The home use of sugar, as such, is also lower in Hawaii, because people of recent oriental origin use much less than Caucasian households, both in preparing, serving, and eating foods. However, their consumption of candy, soft drinks, frozen sweets, and so forth, between meals may be as high as that of other Americans.

(*g*) *Nutritive value of the family diets in terms of eight dietary essentials.* The nutritive value of each family diet was calculated in terms of calories, protein, three essential minerals—calcium, phosphorus, and iron—and three of the important and well-known vitamins—A, B_1,[4] and C. For this purpose a composition table was prepared, giving the calories, protein, minerals, and vitamin values per pound of each of the food items used by the families. The food values of many local foods have been determined by the nutrition department of the Hawaii Agricultural Experiment Station. Composition figures for other foods were obtained from scientific publications of other nutrition laboratories. In the case of a few of the foods, only approximate values were obtainable.

In calculating the total calorie, protein, mineral, and vitamin content of a family diet, deductions were made from the "as purchased" weight of foods for any losses resulting from the discard of the inedible portions (refuse). In some foods, estimated deductions were made from the vitamin values of the raw foods for inevitable losses in cooking, where these were known to be large. In some family-diet studies an additional deduction of 2 to 10 percent is made from the weight of foods purchased to allow for waste of foods in the home (table scraps, food spoilage, and discarded left-over foods). Such deduction was not made in this study, so the extent of nutritional deficiency in these family diets is probably even greater than it was calculated to be.

(*h*) *Nutritive needs of the 38 families in terms of 8 dietary essentials.* The necessary nutritive content of each family's diet (in terms of calories, protein, 3 minerals, and 3 vitamins) for the 28-day period was calculated. The total nutritive content depends on the composition of the family and on the number of meals eaten in the home by members of the family and by guests during the food study. The family's home diet need not supply an individual's daily nutritive requirements for those days, or fractions of days, that he eats his meals away from home (excepting lunches taken from home). In conducting such family diet studies, it is usually assumed that each meal supplies one-third of an individual's daily requirements. In some instances adjustments were made in this study to correct evident errors. For example, when a mother working away from home during the day buys herself at noon only a 10-cent lunch consisting of a small salad and a sandwich, the 2 meals she

[2] Forty pounds per capita per year.

[3] Seventeen pounds per capita per year.

[4] Also called thiamine. Designated for convenience throughout the remainder of this paper as vitamin B.

eats at home obviously must furnish her the other five-sixths (approximately) of her day's nutritive needs.

Individual daily requirements for calories, protein, minerals, and vitamins vary with sex, age, occupation, and state of health; and for mothers there is an increased requirement during pregnancy and lactation. Individual daily allowances for these eight dietary essentials as given by the Bureau of Home Economics, United States Department of Agriculture (22), were used. Additional allowances were made as follows: 25 percent for tuberculosis, 15 percent for pregnancy, and 25 percent for lactation.

(*i*) *Inadequacy of the family diets in calories and protein.* Each family's total nutritive requirements for the 28 days were compared with the nutritive value of its actual diet for the period. Table 8 and figure 1 (pp. 18 and 20) show, in numerical and in graphic form, the extent of the deficiencies found in these 38 family diets.

Table 8.—Extent of dietary deficiencies in the 38 family diets

Dietary essentials	Number of family diets deficient in the various essentials	Percent of total family diets that were deficient in each essential
Calories	26	68
Protein	22	58
Calcium	36	95
Phosphorus	29	76
Iron	26	68
Vitamin A	32	84
Vitamin B_1	35	92
Vitamin C	18	47

Twenty-six of the family diets (68 percent) were found to be deficient in calories, a deficiency which might not be very serious if the shortage were slight. Considering the small stature of many of the adults of oriental origin, and the relatively lower calorie requirement in a mild climate, mainland United States calorie allowances may be slightly high for Hawaii. However, 16 of the family diets (42 percent) were more than 20 percent low in calories. This is an unquestioned deficiency.

Fifty-eight percent of the family diets were deficient in protein, but the average protein intake of the 38 families was only 2 percent low. However, 9 of the diets (24 percent) were more than 20 percent deficient. These 9 families were definitely not getting enough protein.

(*j*) *Serious calcium deficiency in most of the diets.* The most common and most serious dietary deficiency in the group was the shortage of calcium. Thirty-six family diets (95 percent) contained less than the suggested daily allowances for calcium, with an average deficiency for the 36 diets of 47 percent. Twenty-one families (55 percent) were getting less than half of their theoretical allowance for this mineral. This constitutes a very serious calcium deficiency.

(*k*) *Deficiencies in other minerals.* About three-fourths of the family diets were low in phosphorus, and about two-thirds were low in iron. These deficiencies, however, were not so great as in the case of calcium. The diets averaged 14 percent low in phosphorus and 5 percent low in iron. However,

50 percent of the diets were seriously low in phosphorus (more than 20 percent) and 34 percent were seriously low in iron (more than 20 percent).

(*l*) *Diets very low in vitamins.* Our present standards for vitamins are none too high for exuberant and buoyant health and maximum resistance to disease and fatigue. Many recent experiments and observations dealing with human beings suggest that we may need a greater amount of most of the essential vitamins than our present standards indicate.

Most of these 38 family diets provided very much less than the recommended allowances for vitamins A, B, and C (22). Diets that are low in these 3 vitamins are likely to be low in some of the other important vitamins also—riboflavin, nicotinic acid, pantothenic acid, pyridoxine, and others. Normal adults and older children in Hawaii probably receive sufficient vitamin D, the antirachitic vitamin essential for good bone and tooth development, through the action of the sun's rays on the body.

Only 2 of the 38 diets were up to the Bureau of Home Economics standards (22) in all 3 vitamins studied—A, B, and C. Thirty-two diets (84 percent) were deficient in vitamin A, 35 diets (92 percent) in vitamin B, and 18 diets (47 percent) in vitamin C. On the average, the diets were 35 percent low in vitamin A, 44 percent low in vitamin B, and 10 percent low in vitamin C.

(*m*) *Four classes of diets in this group.* Table 9 shows the number of family diets that are below standard in various numbers (1 to 8) of the dietary essentials studied. None of the diets had zero number of deficiencies. Three diets were deficient in only one essential. Fourteen diets were deficient in 7 essentials, and 8 diets in 8.

Table 9.—Number of families having diets with various numbers of deficiencies

Number of deficiencies in the diet	Number of family diets in each category
0	0
1	3
2	1
3	1
4	4
5	4
6	3
7	14
8	8

The diets have been grouped into 4 classes based on the number of deficiencies in each. Figure 2 (p. 20) is a graphic presentation of the distribution of the 38 family diets among the 4 classes. Those diets with 1 or 2 deficiencies constitute class I, which may be called a fair diet. In class II are the diets deficient in 3 or 4 essentials (poor diets). Class III includes all diets deficient in 5 or 6 elements (very poor diets). Those diets with 7 or 8 deficiencies (dangerously deficient diets) are in class IV.

Fifty-eight percent of the family diets are in class IV (dangerously deficient diets), 18 percent in class III (very poor diets), and 13 and 11 percents in the 2 less seriously deficient classes of diets. Three-fourths of the 38 family diets are either very poor or dangerously deficient.

Figure 1.—Graphic presentation of the percent of family diets which were deficient in each of the 8 dietary essentials studied

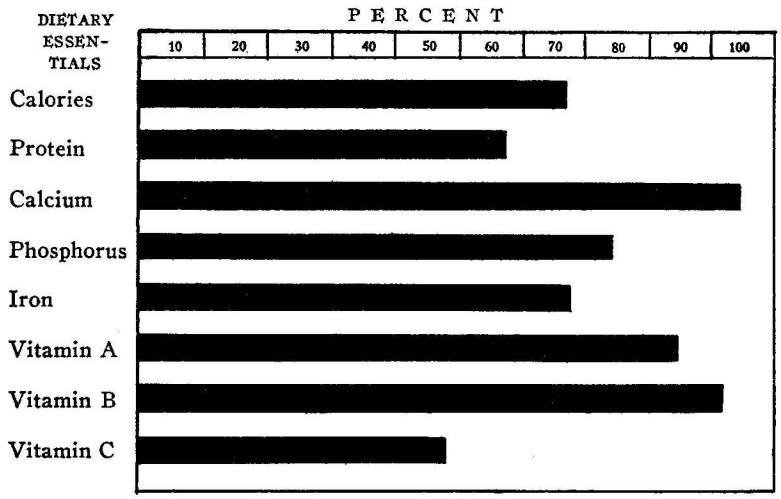


Figure 2.—Percent of family diets in each of 4 dietary classes

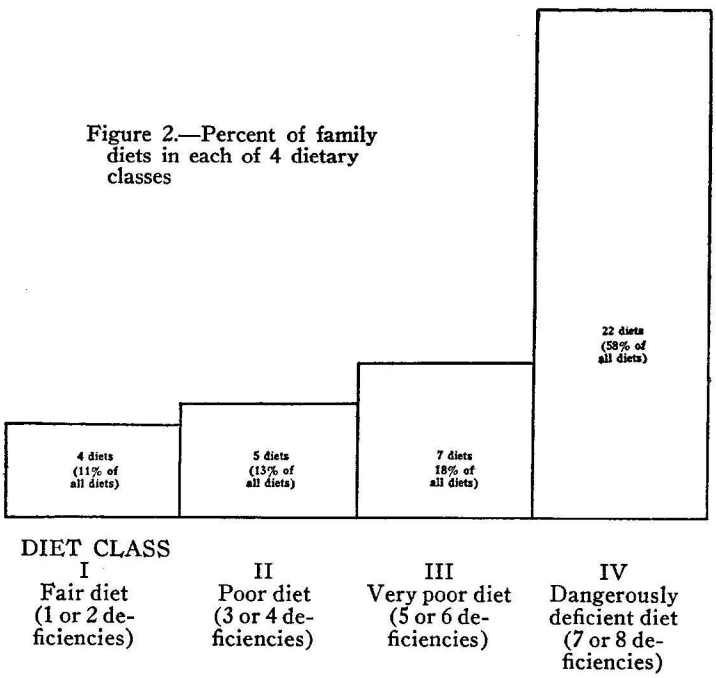


Figure 3.—Scatter diagram of the relation between the per capita money value of the diet and the number of nutritional deficiencies per diet

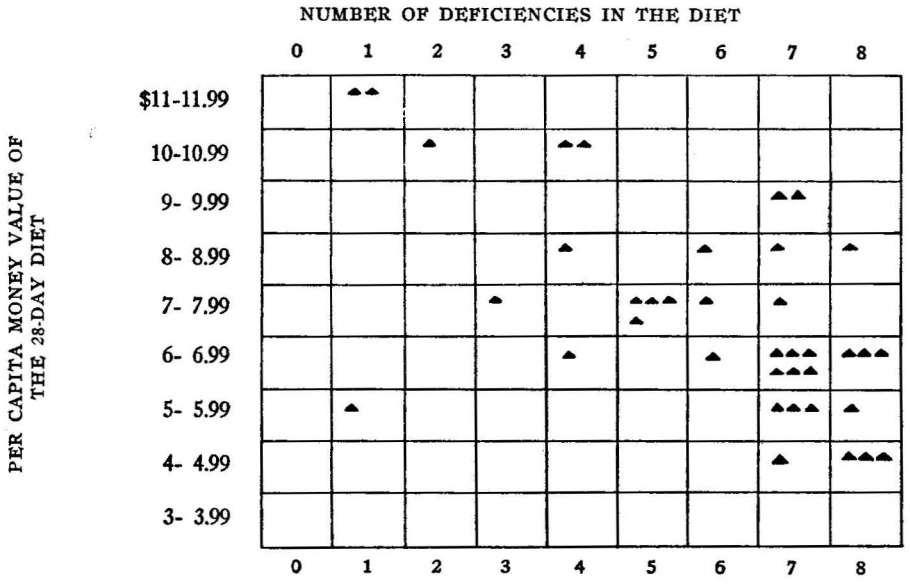
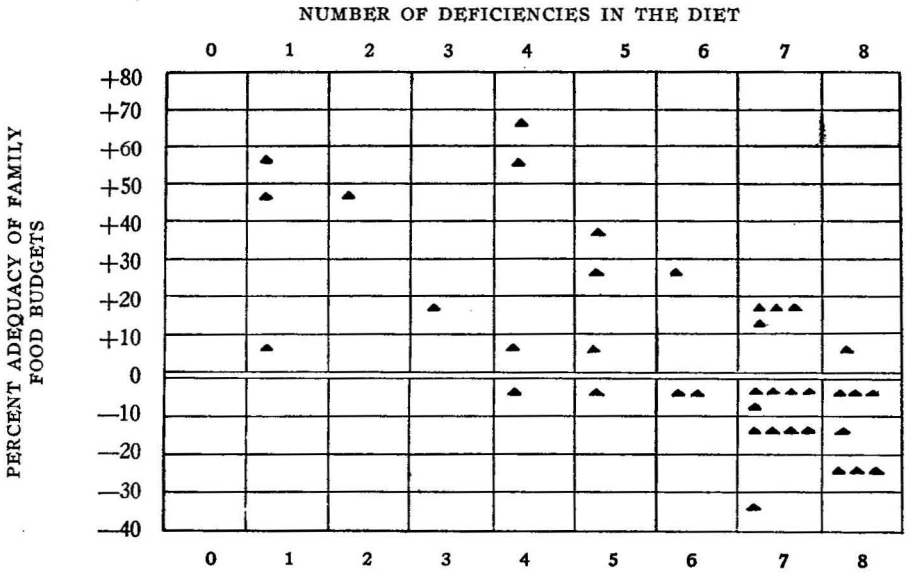


Figure 4.—Scatter diagram of the relation between the percent adequacy of each family food budget and the number of nutritional deficiencies per diet



(*n*) *Relationship between cost and adequacy of the family diets.* The scatter diagram in figure 3 (p. 21) shows the degree of correlation between the per capita money value of the diets and their nutritional adequacy. As the money value increases, diets tend to have fewer deficiencies, and, conversely, low-cost diets are more likely to be deficient than are those at higher cost. The average minimum per capita cost of food per month in Honolulu for an adequate diet was at the time of this study between $6.50 and $7.00 (12). Ten of the 18 family diets at this price level ($6.00 to $8.00 per capita per month) were deficient in 7 or 8 dietary essentials, and all 18 of the diets were deficient in 3 or more essentials.

The scatter diagram in figure 4 (p. 21) shows the relation between the percent adequacy of the family food budgets and the nutritional adequacy of the diets. Of the 16 families spending within 10 percent of their calculated minimum-adequate food budget, only one family was getting a diet that was nearly adequate. All the other family diets in this expenditure group were deficient in 4 or more dietary essentials, and 9 of them were in the "dangerously deficient" class (with 7 or 8 deficiencies). Thirteen family diets were above this level in money value, yet none of these diets was completely adequate, and 4 were deficient in 7 essentials. The 9 families whose food costs were more than 10 percent below their minimum-adequate food budgets all had diets deficient in 7 or 8 essentials.

4. Dental Status of the Children in These 38 Families

Dietary surveys among population groups are important and worth while because of the vital relationship between food and health. The ill effects of a continued inadequate diet may not be immediate, but they are inevitable. If dietary deficiencies can be discovered by means of food consumption studies before possible harm to health occurs as a result of poor diets, the ill effects may possibly be prevented by changing people's food habits through proper nutritional guidance and education.

It is always of value to learn as much as possible about the health conditions of population groups whose food habits have been studied, in order to detect any dietary deficiency states that may be present in the individuals, and also to get additional information regarding the relation between diet and health. No funds were available for any studies of this nature in the group of people whose diets were surveyed in this study. However, through the cooperation of various organizations and individuals in Honolulu,[5] recent dental data on 90 of the 129 school children in these families were secured (table 10, p. 23).

There is no doubt that the condition of the teeth of children reflects to a considerable degree the adequacy, or inadequacy, of their diets. Many more studies are needed regarding the food habits of population groups over a long period of time, and the state of health and dentition of children, in order to show the effect of specific dietary deficiencies at various times of life on health and on the teeth.

The dental data for the 90 school children in these 38 families are shown, in comparison with similar data for 17 other groups of American children, in table 11 (p. 24).

[5] See "Acknowledgments," page 2.

Of course, dental data recorded by different examiners are not always comparable because of varying methods of making examinations, lack of agreement as to just what constitutes a dental cavity, and differences in manner of recording the findings. However, records of dental conditions in general in large groups of children (in different geographic areas or of different racial types) give some indication of relative conditions among the groups.

All of the 90 school children in these 38 families for whom dental data were available were suffering from dental decay (caries), and in many children it was very advanced. The average number of defective teeth per child for the whole group was 9.2. About one half of the 90 children each had 10 or more defective teeth.

There can be no doubt that the dental condition of these children was to a great extent the result of the deficiency of their diets in the minerals and vitamins known to be essential for the formation and maintenance of good teeth.

Available data on other groups of children in Hawaii may be noted for comparison. Of 216 school children of Japanese origin examined in rural Oahu and Kona (25), 100 percent also were found to have decayed teeth (table 11, p. 24), with an average of more than 9 defective teeth per child. One hundred seventy-nine school children with Hawaiian ancestry examined in rural Oahu (25) had a slightly better record: 98 percent had dental decay and there was an average of about 8 defective teeth per child.

In 2 rural public schools in east Maui, 123 school children with Hawaiian ancestry were examined, and 86 percent were found to have decayed teeth (25), with an average of 4 defective teeth per child. Here the consumption of home-grown foods (taro, other vegetables, and fruits) and fish is high and that of commercially refined and processed foods relatively low.

Table 10.—Dental status of school children in the 38 Honolulu relief families

	Age in years at nearest birthday													
	6	7	8	9	10	11	12	13	14	15	16	17	18	All
Number of children	3	14	6	15	12	6	6	8	6	8	3	2	1	90
Percent of children with defective teeth	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Number of defective teeth per child[1]														
Average ..	11.3	11.9	11.3	8.5	8.3	5.3	9.3	7.4	11.2	7.9	6.7	9.5	4	9.2
Range	4–17	3–18	7–17	2–13	2–15	2–10	4–12	4–10	3–16	1–13	2–10	4–15		1–18

[1] Including both temporary and permanent teeth.

Dental data for some school children in Honolulu and on the island of Kauai (313, including all racial groups), as recorded by Dr. Guy S. Millberry (15), show these children to have slightly better teeth than those in rural Oahu and Kona but more extensive decay than the children in rural east Maui.

The extent of dental decay in the 90 school children in the 38 Honolulu relief families is more serious than it is in 3 of the other 4 groups of unselected school children in Hawaii for whom dental data are available. The average dental status of all the 921 school children in Hawaii for whom data are available (95 percent having dental decay) is a little better than that of school children in Maine (99 percent with decay), and similar to that of the group of children in the low-fluorine-water district near Chicago (96 percent), of those in Maryland (96 to 97 percent), and of those in San Francisco (94 percent).

Table 11.—Percent of school children having dental caries, in Hawaii and in other areas of the United States

Location and racial group	Percent of children with caries	Age range	Number of cases	Dates of study
38 Honolulu relief families (Mixed racial group)	100	6-18	90	1939-41
Rural Oahu and Kona (25) (Japanese)	100	6-20	216	1938-41
Rural Oahu (25) (Hawaiian)	98	6-18	179	1938-41
Rural East Maui (25) (Hawaiian)	86	6-15	123	1940
Honolulu and Kauai (15) (Mixed racial group)				
Grade I	90	6-8	175	1940
Grades VI and VIII	96	11-15	138	1940
Chicago suburbs (8) (White)				
1.2 to 1.8 p.p.m. fluorine in water	76	12-14	1,421	1941
0.5 p.p.m. fluorine in water	89	12-14	403	1941
No fluorine in water	96	12-14	1,008	1941
Florida (1) (White)				
Those using milk	33	6-19	186	1930
Those not using milk	66	6-19	220	1930
Georgia, Illinois, Maryland, and Missouri (24) (White)	92	6-19	12,435	1931
Maine (7) (White)	99	5-14	637	1934-36
Maryland (14) (White)	96-97	13-19	1,841	1940
San Francisco (20) (White)	94	12-18	6,923	1940
Texas (29)				
(White)	70	6-21	3,742	1934
(Mexican)	65	6-20	289	1934
(Negro)	45	6-20	895	1934
United States (13) (American Indians, on 76 reservations)	78	12-19	3,996	1929-32

Dental decay seems, according to the data here presented, to be more extensive among children in Hawaii than it is among many children in the mainland United States, including Negro, Mexican, American Indian, and some groups of white children (table 11, p. 24).

5. Significance of the Findings

(*a*) *Deficiency of the diets.* Previous investigations in Hawaii (16, 27), and also studies in the mainland United States (21, 22), have shown many family diets to be seriously deficient in vitamin B and in calcium, and less so in other dietary essentials. However, the diets of these 38 Honolulu relief families are more seriously deficient, on the whole, than are the diets of families with low and moderate self-earned incomes in general throughout the United States.

The minimum-cost-adequate food budgets allowed for these relief families provided sufficient funds for a satisfactory diet. This minimum-cost-adequate food budget has been followed for a two-week period by one non-relief family in Honolulu, and the nutritive value of the diet secured with the funds allowed was calculated. The diet was found to be psychologically satisfying as well as nutritionally adequate. This food budget provides more money than many self-supporting low-income families spend for food. Yet none of these 38 relief families had an adequate diet, either because they did not spend all their food money for food or because they did not buy the right kinds of foods.

Even though no outright cases of vitamin or mineral deficiency diseases other than dental decay had been recorded for any of these families just prior to or during the time of the study, such poor diets as many of these families were living on will inevitably produce a "hidden chemical hunger" which will be a contributory cause in the development of many diseases in the future.

If all the 38 families in this study were seriously in need of nutritional guidance, then those relief families who had less interest in nutrition and did not wish to cooperate, and also those families who were not studied because of serious illnesses, are probably much more in need of such guidance.

(*b*) *Dental decay.* The extensive dental decay among the school children in these 38 families is no doubt to a great extent the result of their poor diets. This dental condition constitutes a real health problem. Active caries are indicative of other nutritional deficiencies, which may or may not be apparent at the time. Dental health has come to be recognized as a major subdivision of the whole problem of national health conservation (6). The bad effects of decaying or abscessed teeth on the health and development of young children are obvious, and no effort should be spared to prevent the occurrence of such conditions.

An adequate diet is generally conceded to be one of the most important factors in good dentition. A diet adequate in the tooth-building and tooth-protecting minerals and vitamins is essential throughout life for good teeth and good health, but it is most important for the expectant and nursing mother, the infant, and the growing child (19). However, poor teeth and poor health (at least in children) will be improved at any time by a change in diet from one that is deficient to one that is adequate for good dentition and health (3).

Poor teeth are not only a great health hazard but also a continual expense for both the family and the community. In dental decay, as in tuberculosis and

many other diseases, an ounce of prevention is worth a pound of cure and is very much cheaper. Teaching nutrition to mothers and to school children should lead to better diets, to development of the right food habits early in life, to better teeth and better health.

The mineral fluorine (present in our foods and water to the extent of only a few parts per million) has recently been suggested as a factor in the development of sound teeth (8). The optimum amount of fluorine in the drinking water for good dentition is estimated to be about one part per million. Three or more times this amount will cause mottled (brown) enamel, which if severe decreases the tooth's resistance to decay. Much less than one part per million, or no fluorine at all, is said to cause dental decay. Many samples of drinking water in Hawaii have been found by the chemistry department of the University of Hawaii (17) to contain very much less than one part per million of fluorine, the optimum amount believed by some investigators to be necessary for the development of decay-resistant teeth. Whether this low fluorine content of the drinking water may be a contributing cause in the extensive dental decay found in these and other children in Hawaii has not been considered in this study.

6. Summary

Thirty-eight relief families in Honolulu cooperated in a study of family food habits and the nutritive adequacy of family diets. Each family kept a record for a period of 4 weeks of all foods consumed. The calories, protein, calcium, phosphorus, iron, and vitamins A, B_1, and C furnished by each family's diet were calculated and compared with the standards for these nutrients recommended by the Bureau of Home Economics (22). Not one family diet was found to be completely adequate to meet the estimated nutritive needs of the family members for normal growth, good health, resistance to disease, and optimum working efficiency. Three fourths of the family diets were found to be deficient in 5 or more dietary essentials, and over half of them in 7 or 8.

The greatest deficiencies were the shortages of calcium and of vitamin B_1. Ninety-five percent of the family diets were deficient in calcium, with an average deficiency of 47 percent. Ninety-two percent of the diets were deficient in vitamin B_1, with an average deficiency of 44 percent.

During the 4 weeks of the food study, these families spent 5 percent more, on the average, than the minimum amount of money necessary to obtain nutritionally adequate diets. The fault lay, in most instances, in wrong choice of foods—too little milk and whole-grain cereal foods, too much refined cereal foods and meat, too few of the green and yellow vegetables, and too many expensive prepared foods. Of the 16 families spending within 10 percent of their minimum-cost adequate food allowances for food, 15 had diets deficient in at least 4 dietary essentials and 9 had dangerously deficient diets (deficient in 7 or 8 essentials). About half the families were not spending enough money to secure nutritionally adequate diets, although all their grants made allowance for adequate food budgets.

Dental data were obtained on 90 of the 129 school children in these 38 families. All were found to have dental caries, with an average of 9.2 decayed teeth per child.

The significance of the findings is discussed.

SECTION II. SUGGESTIONS FOR OBTAINING A MORE ADEQUATE FAMILY DIET ON A LIMITED FOOD BUDGET

1. Dietary Information Given to Each of the 38 Families, Following the Food Study

When the dietary calculations were completed, each family was shown the results of its own study and was given specific suggestions for the best way of spending the food money to get an adequate diet. This summary was presented and explained to the family in a personal interview by the person who had helped collect the food consumption data.

This information on the amounts and costs of the various kinds of foods used during the 4-week period was presented to the family in the form shown in the Typical Summary Sheet, page 28. The data given in this Summary Sheet are the averages for all the 38 families, as recorded also in table 6, page 15.

Below the dietary data in the Summary Sheet are 10 "suggestions for a more adequate diet." Those suggestions which were especially applicable to a family were indicated by check marks on its summary sheet. These were called to the attention of the mother (or whatever member of the family had cooperated in the food study) at the conclusion of the study. Items 5, 7, 8, 9, and 10 were applicable to all the families. Two families in the group were using enough milk, so for them item 6 was not checked. Two family diets were adequate in calcium (item 1); 6 diets were adequate in vitamin A, 3 in vitamin B, and 20 in vitamin C (items 2, 3, and 4). For a few of the families all 10 of the items were checked.

Each mother was also given a copy of a simple illustrated mimeographed pamphlet, Good Food for Good Health (prepared by the nutrition department of the Hawaii Agricultural Experiment Station), containing some suggestions for obtaining an adequate diet at low cost.

On the Summary Sheet the suggested distribution of the family food budget for each individual family was given just below the data on the amounts and costs of foods eaten by the family during the 4-week period. The food budget

given here is for a typical family, consisting of a mother and four or five children, for a 30-day period. Each family's summary sheet gave its theoretical 30-day food budget. Each food budget was calculated from the family composition and the individual money allowances for food given in the Report of the Committee on a Minimum Standard of Living and Its Cost (12), allowing an increase of 15 percent because of the recent rise in food costs.

The suggested distribution of the family food budget among the various kinds of food, as given in the Summary Sheet, is based on recommendations by the Honolulu Council of Social Agencies. Some adjustments were made in this distribution of food money in accordance with each family's food habits.

2. From an Unplanned to a Planned Food Budget

Education in proper food budgeting is important if mothers with limited food money are to provide nutritionally adequate diets for their families. No family food budget, not even the most generous, can obtain a nutritionally adequate family diet if a large part of it is spent for refined starches and sweets, expensive prepared foods, out-of-season vegetables and fruits, or foods with high appetite appeal but low nutritive value. It is often mistakenly believed that expensive foods are higher in nutritive value than the less expensive foods and that this justifies their purchase on a limited budget. Frequently the reverse is true. High-priced foods are high-priced because they have been shipped some distance or because they have been refined or otherwise processed. Such foods may be lower in nutritive value than the less expensive locally produced foods and the unrefined foods.

If a general budget plan carefully prepared by the social worker in cooperation with the client is considered important in helping the family to spend its very limited funds most wisely, then the food budget merits special consideration, as it is the largest and most important item in the family budget. It bears a vital relationship to the health and earning capacity, both present and future, of the members of the family.

The suggested distribution of a family food budget, such as given in the Summary Sheet, calls for drastic changes in food habits in all of the 38 families. The suggested money expenditure for milk for most of the families was at least three times the amount they had been spending for this food. The suggested expenditure for vegetables and fruits was a little higher, and that for cereals a little lower, than the amounts previously spent for these foods. It was suggested that at least half of the cereals purchased be whole-grain. Many of the families had used no whole-grain cereals, others but a small amount. The average amount spent per family during the study for fats, sweets, and miscellaneous foods was a little below the 15 percent of the food budget allowed for these foods in Stiebeling and Ward's recommended distribution of the food money (23). However, it was not suggested to the families that they increase their expenditures for this group of foods, because fats, with the exception of butter, "fortified" margarine, and cod liver oil, are not protective foods. The amount of money saved here (about $1.00) was added to the 15 percent of the

TYPICAL SUMMARY SHEET GIVEN FAMILIES AFTER COMPLETION OF THE 28-DAY FOOD STUDY

Weights and costs of foods for typical family and recommendation for better distribution of food money

Family No..... Location..... Dates of the food study.....

	Vegetables	Fruit	Milk	Cereals		Fats and oils	Sweets	Miscellaneous	Meat, fish, eggs	Meals out	Total
				Brown	White						
Pounds of food eaten[1]	77	50	49	14	93	7.2	11.8	9.7	45		357
Total cost of food eaten[1]	$4.95	$2.77		$ .92	$ 6.78	$2.16	$ 1.20	$1.56		([2])	
	$7.72		$ 4.27	$7.70		$ 4.92			$12.06	([3])	$36.37
Suggested distribution of the food budget (12)	$8.50		$10.00	$ 3.25	$ 3.25	$4.83			$ 7.50		$37.33[4]

[1] Including home-grown food and food gifts brought to the home.
[2] Food purchased and eaten away from home.
[3] Food received free and eaten away from home.
[4] For a family consisting of a mother and 4 or 5 children, for 28 days. (Average family composition in this group was one adult and 4.5 children.) About 15 percent increase was allowed, because of higher food prices in 1941, over the cost of the minimum-adequate food budget, as calculated from the "Report of the Committee on the Minimum Standard of Living and Its Cost" (12). This is a 7 percent increase over the cost of a minimum-adequate diet in 1940, at the time the family food data were collected.

SUGGESTIONS FOR A MORE ADEQUATE DIET

1. Diet is low in calcium. Use more milk and vegetables.
2. Diet is low in vitamin A. Eat more green and yellow vegetables and yellow fruits. Eat liver once a week.
3. Diet is low in vitamin B. Eat more brown rice, brown bread, rolled oats, and other whole-grain cereals, taro, poi, sweetpotatoes, potatoes, breadfruit, dried peas and beans, peanut butter.
4. Diet is low in vitamin C. Eat more green-leaf vegetables, bean sprouts, papayas, oranges, guavas, tomatoes, mangoes, potatoes.
5. Use more brown rice, whole-wheat bread and other brown breads, rolled oats, and other whole-grain cereals.
6. Use more milk, fresh or evaporated. Buy evaporated milk in tall cans.
7. Same money on meats. The cheaper cuts are as high in food value as expensive cuts. All organ meats are higher in nutritive value than muscle meats, and often cheaper. The lower-priced canned salmon is as high in nutritive value as the expensive brands.
8. The following vegetables are very nourishing: sweetpotatoes, potatoes, breadfruit, taro, all green-leaf vegetables, all yellow vegetables, dried peas, and beans.
9. Some good fruits are: bananas, papayas, mangoes, pineapples, guavas, avocados, tomatoes, oranges, dried prunes, apricots, raisins, and peaches.
10. Unrefined sweets—raw brown (washed) sugar, guava jam and jelly, papaya-pineapple jam, mango jam, apricot jam—are best. Use peanut butter on bread sometimes in place of jam. Candy is not good for children.

NUTRITION DEPARTMENT
HAWAII AGRICULTURAL EXPERIMENT STATION
HONOLULU, T. H.

Cooking School for mothers held at St. Mary's Mission, King Street.
Day and hour: Wednesday, 1:00 p.m.

food budget allowed by Stiebeling and Ward for meat, fish, and eggs. In spite of this extra allowance, the suggested expenditure for meats was in all cases very much lower than the amount which the family had spent for this food group during the 4-week study.

These families cannot so suddenly and drastically change their food habits as would be required by the suggested redistribution of their food money among the various food groups. They must be gradually educated and carefully guided over a period of time toward different food habits until their diets contain enough of the protective foods, which are rich in minerals and vitamins, and only a minimum of the foods that furnish chiefly calories. The mothers need to be taught how to prepare and serve these foods and how to train the family to eat them.

3. Common Errors in Food Buying and How to Avoid Them

The unwise use of food money frequently noticed in the family records in this study indicates that these mothers and their families would benefit greatly by guidance in the management of their food budgets. One error lies in buying too much of cooked or canned foods. If the mother is at home all day, it is a mistake to buy prepared foods when the same food can be bought raw for much less money and prepared at home. The mothers in these families often bought canned foods, prepared breakfast cereals, roasted meats, cooked vegetables, and other prepared dishes, instead of buying raw foods at much less cost and cooking them at home.

Another common error made by these families was paying too much money for meats. High-priced muscle meats contain no more nutritive value than cheaper cuts, and the relatively large amount of bone in some cuts greatly increases the cost of the edible portion. Glandular and organ meats (liver, kidney, tripe, heart, brain, lungs, intestines, and sweetbreads, etc.) are all higher in nutritive value than muscle meat, and are, with the exception of fresh beef liver and veal liver, often less expensive. Frozen beef liver and fresh pork liver are inexpensive and very high in nutritive value. Cooked, roasted, canned, or cured meats are often higher in price than fresh or frozen. Fresh fish on the market vary greatly in price; the high-priced ones have no greater nutritive value than the low cost varieties. But again, the proportion of inedible material present must be considered. Canned salmon is an excellent food—a good source of protein, and of calcium if the bones are eaten. (The bones can be finely crushed and mixed with the fish.) These families paid from 15 to 40 cents a pound for canned salmon. Except for the vitamin A content, the lower-priced varieties are as high in nutritive value as the high priced, and this deficiency in vitamin A is not significant in a locality like Hawaii, where fresh green vegetables are available the year round. Those who paid above the minimum price for canned salmon paid more than necessary.

Several families bought powdered gelatine with added sugar and flavoring. Such mixed powders consist largely of sugar, which is bought at a very high price per pound. Gelatine is protein, but of very poor quality; it is lacking in

certain of the essential amino acids, or constituent building blocks, of which protein foods are composed. Its mineral and vitamin value is practically zero.

Many families bought high-priced local eggs instead of the cheaper mainland eggs, which are just as high in nutritive value and which can be prepared in such a fashion that they taste as good as fresh eggs.

Many of these families paid unnecessarily high prices for canned foods. The prices of canned foods and the claims printed on the labels are not always safe guides in determining quality and nutritive value (11). Canned foods at a high price always give low nutritive value per unit cost. Many of these families paid unnecessarily high prices for canned foods.

Money spent for sweets may be misspent or it may be spent wisely. These families often bought their sweets unwisely. Only one of the 38 families used raw or washed sugars, which are not only cheaper than refined sugar in many stores, but also are as high in energy value, and possibly contain some undetermined substances of nutritive value in addition to the energy. It has been found in several studies that unrefined sweets are less harmful to the teeth than refined sweets (26). These families often bought commercially prepared jams and jellies, which are much more expensive than home-made varieties. They should be instructed to prepare their jams and jellies at home and to make those that are rich in vitamins. Guava jam and jelly are rich in vitamin C, citrus marmalades contain vitamins A and C, and jams made from yellow fruits contain vitamin A. Other jams and jellies are likely to have little or no vitamin content.

Most of the families bought some candy, and some of them may have bought more than was recorded. An occasional piece of candy may not be regarded as a health hazard but moderate to large amounts are known to be detrimental to the teeth of children (9, 19, 28, 30). If the diet is already inadequate in minerals and vitamins, the addition of candy exaggerates these deficiencies, by lowering the proportion of minerals and vitamins to calories. From soft drinks and most frozen sweets (except ice cream made from milk and cream) one usually obtains little or no food value other than often unnecessary calories. The energy content of these foods costs the buyer from 10 to 30 times its actual value. One family reported an expenditure of $3.20 for candy in the 28 days. Half of this money, if spent for unrefined sweets, properly prepared at home into tasty, nutritious dishes, would have yielded much more nutritive value and just as much psychological satisfaction. This would have left $1.60 with which to buy a large amount of the milk and other protective foods which this family lacked.

Money that buys milk at reasonable cost is always well spent. As Sherman says, " 'Milk builds bone and muscle better than any other food.' And more than this, milk is both the cheapest and the surest protection from the nutritional deficiencies which open the way to diseases and lifelong injuries to health" (18). The average per capita milk consumption in Hawaii is about half that on the mainland, and that on the mainland is less than that required for ideal nutrition. Only 2 of these 38 families used enough milk. If the mothers in these families had known how to buy and use milk wisely, all these

family diets might have contained enough milk. Evaporated milk is much cheaper than fresh milk and very little lower in nutritive value—lower in vitamins B and C (5). Evaporated milk is always safe, is readily digested by even the youngest infant, keeps well, can be bought in quantity (by the case, thus saving on cost), and is easily stored. When evaporated milk is bought in the tall cans (14½ oz.), the customer gets about 20 percent more for his money than when the small cans (6 oz.) are purchased. Evaporated milk can be used in place of fresh milk in a great many instances, if not in all.

A knowledge of the properties of various fats would have enabled these mothers to buy these foods more wisely. Oleomargarines fortified with vitamin A are usually much cheaper than butter. They are equal to butter in fat content and calorie value, and are as readily digested as butter, but are usually lower in vitamin A than the best butter. This difference could easily be overcome by using a few more green leaf vegetables, which are always available and cheap in Hawaii. Home-rendered lard is often less expensive than commercially rendered fats or hydrogenated oils.[1] Vegetable oils become rancid less readily than animal fats and are therefore more satisfactory in homes without refrigeration. They are often lower in price than commercially rendered animal fats and hydrogenated oils and are equal to them in energy value.

Many families purchased expensive prepared breakfast cereals. Cereals to be cooked at home are always cheaper and often more nutritious. Rolled oats, dark farina, rolled whole wheat, and whole yellow cornmeal are inexpensive uncooked whole-grain cereal foods which are very high in nutritive value. These were used by very few of the 38 families.

Only one family used day-old bread regularly, though it was available to several of the 38 families. This is as high in nutritive value and as palatable as fresh bread, is generally considered preferable to fresh bread for small children, and is very much cheaper.

Seven of the 38 families used no brown rice, brown breads, or other whole-grain cereal foods. The average amount of whole-grain cereal products used per family in the 4-week period was only 14 pounds, or 13 percent of the total cereal foods used. All whole-grain foods are very much higher in nutritive value than refined cereal products (even when the latter are fortified with some vitamins and minerals) and cost very little more, if any. When rice and wheat are refined, only the inner part of the grain (chiefly starch) is retained and used as food. The outer 12 to 30 percent, which is discarded, contains over 90 percent of all the 8 or more vitamins, over 80 percent of all the 10 or more essential minerals, and a valuable part of the protein present in the whole grain. That is why whole-grain foods, which retain all this nutritive value, are classed as protective foods. Low-cost diets are inevitably high in cereal products. But, if the diet is to be adequate in minerals and vitamins, two thirds or more of the cereal foods used should consist of whole-grain or partially refined products.

Dried legumes (peas, beans, lentils) and dried fruits (prunes, apricots, peaches, raisins) are nutritious and economical foods, but most of these 38 families did not use them.

[1] Liquid vegetable oils converted into a solid white fat through treatment with hydrogen.

Local fresh fruits and vegetables in season usually give the customer the most value for his money when buying this group of foods. Even in cold storage, mainland fruits and vegetables lose some vitamin C during the 2 or 3 weeks time between harvesting and eating. (One exception is citrus fruits, which, as a rule, retain practically all their vitamin C in storage.) Green and yellow vegetables are much richer in minerals and vitamins than those that are white or very light in color. For example, yellow sweetpotatoes and yellow squash are rich in vitamin A, while white potatoes and white squash contain practically none. Green leaf cabbage and green lettuce contain 50 to 100 times as much vitamin A and 3 times as much iron as the white or pale green varieties. If these families had known this, they could have bought their vegetables more wisely and could have obtained much more nutritive value for the same money.

A small home garden—even a few flower pots of fresh, growing parsley on a sunny window sill—can supply a family many thousand units of vitamins every week. Several of the families who were making no attempt to produce any foods at home could have had small vegetable gardens or a few fruit trees growing near the house. Green leaf vegetables, carrots, and papayas are all easily and quickly grown and require little space (4).

Some foods high in nutritive value and low in cost (or free) which were not used by any of these families and which might have been obtained in a number of cases were:

(a) Rice bran (polishings), 3 cents a pound, 10 times as high in vitamin B as whole-grain cereals;

(b) Powdered skim milk,[2] 10 cents a pound, equivalent in nutritive value to 9 pints of skim milk, rich in calcium, vitamin G (riboflavin), and protein of excellent quality;

(c) *Kirazu,* a byproduct of *tofu* manufacture, containing protein, vitamin B, and calcium;

(d) *Sake no kasu,* a byproduct of *sake* brewing, free of charge, rich in vitamin B because of its yeast content;

(e) Wet yeast, a byproduct of beer brewing, free of charge, very rich in all the B vitamins.

Utilization of these highly nourishing and inexpensive food byproducts would improve the diets of many families, but their use is even more important for families whose diets are inadequate and whose food budgets are limited.

The most frequent errors in food buying were: selecting the wrong kinds of vegetables and fruits; using too little milk and using all fresh milk instead of part evaporated milk; buying too high-priced meats and too little of the organ meats; using too much of refined cereals, instead of whole-grain products; buying fresh instead of the less expensive day-old bread when available; buying foods in uneconomical quantities; buying expensive cooked meats and vegetables, canned foods, and prepared breakfast cereals rather than doing home

[2] Methods of handling powdered skim milk in small packages for the retail trade must be developed, and instructions for storage and use in the home must accompany any campaign for the use of this product.

cooking; buying refined instead of unrefined sweets; not using the low-cost, or free, highly nutritious food byproducts of such industries as rice milling, tofu manufacture, and sake and beer brewing.

4. Cooking Classes for Mothers

Free cooking classes for mothers were held in Honolulu at five different centers, in the summer of 1941. One or more sessions a week were held at each center. These were conducted by a public health school nurse and several home economics teachers, and supported by Federal funds for vocational education. Each mother who participated in this family food study was informed of the location, day, and hour of the cooking class nearest her home and was urged to attend. This information was recorded at the bottom of the family summary sheet. (See Typical Summary Sheet, p. 28.)

Cooking is not only an art (and very important as such, for good digestion and utilization of food are to a large extent dependent on its appearance and taste) but also a science. Properly selected nutritious foods can easily be ruined by incorrect cooking. Their flavor and appearance are no criteria of the amount of mineral and vitamin value lost or retained in the cooking process. A knowledge of correct food preparation is even more important for mothers with low food budgets than for those with more money to spend. The low-cost diet cannot afford to lose any of its minerals and vitamins through wrong preparation, and it must be made very palatable to compensate for some inevitable monotony due to restricted selection of foods.

Careful instruction in selection and preparation of food for preschool children is important for all mothers, but especially so for mothers with limited food budgets. The child from two to six has rightly been called the "forgotten child." Many mothers neglect correct diet during these early formative years, although it is extremely important for building strong bones, teeth, muscles, organs, blood, nerves, and brain. It is during these years that the seeds of poor health through poor diet are often sown, resulting in low resistance to disease and fatigue throughout life.

5. Surplus Commodity Foods

At the time of this food study, Federal Surplus Commodity foods were not yet available to relief families in Honolulu. The first shipment of these foods, received in February 1941, included seven commodities: bacon, dried beans, wheat cereal, white flour, lard, potatoes, and dried raisins.[3] As some of the foods—like lard and white flour—are low in minerals and vitamins, mothers must be taught how to use them to the best advantage and to select other foods in the diet to supplement them. Otherwise, the use of certain surplus commodities will not result in improved diet for relief families.

Some recipes for the preparation of dried beans, one of the surplus foods to which the clients were unaccustomed, were devised in May 1941 by the department of home economics of the University of Hawaii and distributed by

[3] Since that date, ten other commodities—including evaporated milk, canned tomatoes, and grapefruit juice—have been received for distribution to relief families in Hawaii.

the Department of Public Welfare to relief families. Further suggestions for the utilization of surplus commodity foods would be helpful to the families in making the best use of these foods.

6. Food Budget Guidance During a Time of Food Shortage

Food budget guidance for relief families and low-income families is especially necessary in these times of rising food prices, and also in the face of a possible food emergency in the Territory. Families on relief cannot store food staples and canned foods against a possible food shortage, as many other families are doing at present (July 1941). If there should be a food shortage in the Territory, such families would suffer sooner and more severely than any others. Any further decrease in the nutritive value of their already poor diets would be sure to result very soon in an increase in disease. These, and probably also many other families, have been living for years on a submarginal diet, a diet inadequate for building physical reserves with which to meet emergencies.

7. Need for Nutrition Guidance

These families need instruction and guidance in food buying and planning. Most of them were eager to learn the results of their food study and were glad to get the suggestions for securing a more adequate family diet. Many have made specific improvements in family food habits as a result of their cooperation in this study, increasing their consumption of milk, vegetables, fruits, brown rice, brown bread, liver, and raw sugar.

That these families would be responsive to further nutritional guidance is indicated by their interest in the present study. Other families also, both those on relief and those with low, self-earned incomes, would no doubt be interested in and would benefit from guidance in their food purchases and diet planning. Two studies conducted in New York City showed the effectiveness of nutrition teaching to similar families with limited food budgets (2, 10). With a great number of refined, processed, and fabricated foods (many of which are lower in minerals and vitamins than "natural" foods) on the market today, it requires a knowledge of food values to select an adequate family diet at any price level. Even the most generous food budget cannot make good a lack of knowledge of nutrition. How much more knowledge, discretion, and self-control are required to secure an adequate diet with a limited food budget!

LITERATURE CITED

(1) AHMANN, CHESTER F., ABBOTT, OUIDA D., and WESTOVER, GEORGIA.
1930. A NUTRITIONAL STUDY OF THE WHITE SCHOOL CHILDREN IN FIVE REPRESENTATIVE COUNTIES OF FLORIDA. Florida Agr. Expt. Sta. Bul. 216, 50 pp., illus.

(2) BOVÉE, DOROTHY L., and DOWNES, JEAN.
1941. THE INFLUENCE OF NUTRITION EDUCATION IN FAMILIES OF THE MULBERRY AREA OF NEW YORK CITY. Milbank Memorial Fund Quarterly 19: 121-146.

(3) BOYD, J. D., DRAIN, C. L., and NELSON, M. V.
1929. DIETARY CONTROL OF DENTAL CARIES. Amer. Jour. Dis. Children 38: 721-725.

(4) BROWNE, ASHLEY C.
1940. PROTECTIVE FOODS FROM SUBSISTENCE GARDENS. Hawaii Univ. Agr. Ext. Bul. 35, 18 pp., illus.

(5) CARPENTER, ROWENA S.
1933. MILK FOR THE FAMILY. U. S. Dept. Agr. Farmers' Bul. 1705, 29 pp., illus.

(6) CLARK, TALIAFERRO, and BUTLER, HARRY B. (revised by LLOYD, R. S.)
1937. CHILDREN'S TEETH, A COMMUNITY RESPONSIBILITY. U. S. Pub. Health Serv. Rpts. Reprint No. 622, 12 pp., illus.

(7) CLAYTON, MARY M.
1940. THE FOOD HABITS AND PHYSICAL CONDITION OF CHILDREN IN SELECTED COMMUNITIES IN MAINE. Maine Agr. Expt. Sta. Bul. 401, 154 pp., illus.

(8) DEAN, H. TRENDLEY, JAY, PHILIP, ARNOLD, FRANCIS A., and ELVOVE, ELIAS.
1941. DOMESTIC WATER AND DENTAL CARIES. U. S. Pub. Health Serv. Rpts. 56: 761-792, illus.

(9) FOSTER, CONSTANCE J.
1940. TEETH. Hygeia 18: 973-976.

(10) GILLETT, LUCY H., and RICE, PENELOPE B.
1931. INFLUENCE OF EDUCATION ON THE FOOD HABITS OF SOME NEW YORK CITY FAMILIES. New York Association for Improving the Condition of the Poor.

(11) HAUCK, CHAS. W.
1939. A STUDY OF QUALITY AND RETAIL PRICES OF OHIO-PACKED VEGETABLES. Ohio Agr. Expt. Sta. Mimeograph Bul. 123, 11 pp.

(12) HONOLULU COUNCIL OF SOCIAL AGENCIES.
1937. REPORT OF THE COMMITTEE ON A MINIMUM STANDARD OF LIVING AND ITS COST. 28 pp. (Food costs revised, August 1940.)

(13) KLEIN, HENRY, and PALMER, CARROLL E.
1937. DENTAL CARIES IN AMERICAN INDIAN CHILDREN. U. S. Pub. Health Serv. Bul. 239, 54 pp., illus.

(14) KLEIN, HENRY, and PALMER, CARROLL E.
1940. STUDIES ON DENTAL CARIES. IX. THE PREVALENCE AND INCIDENCE OF DENTAL CARIES EXPERIENCE, DENTAL CARE, AND CARIOUS DEFECTS REQUIRING TREATMENT IN HIGH SCHOOL CHILDREN. U. S. Public Health Serv. Rpts. 55: 1258-1268.

(15) MILLBERRY, GUY S.
1940. DENTAL HEALTH EDUCATION AND DENTAL HEALTH SERVICE IN HAWAII: A SURVEY. Sponsored by the Strong Foundation, Honolulu. 185 pp., illus.

(16) MILLER, CAREY D.
1938. A STUDY OF THE DIETARY AND VALUE OF LIVING OF 44 JAPANESE FAMILIES IN HAWAII. Univ. of Hawaii Bul. v. 18, No. 2, 27 pp.

(17) NEKOMOTO, ROBERT S.
1940. A DETERMINATION OF FLUORINE IN HAWAIIAN WATERS. 38 pp. Master's thesis, Univ. of Hawaii, Honolulu.

(18) SHERMAN, HENRY C.
1931. EMERGENCY NUTRITION. Child Health Bul. Nov., 4 pp. (Copyrighted by the American Child Health Assoc., New York City.)

(19) SIMMONDS, NINA.
1938. PRESENT STATUS OF DENTAL CARIES IN RELATION TO NUTRITION. Amer. Jour. Pub. Health 28: 1381-1387.

(20) SLOMAN, ERNEST.
1941. SEX AND AGE FACTORS IN THE INCIDENCE OF DENTAL CARIES. Jour. Amer. Dent. Assoc. and Dent. Cosmos. 28: 441-444.

(21) STIEBELING, HAZEL K.
1941. ARE WE WELL FED? U. S. Dept. Agr. Misc. Pub. 430, 28 pp., illus.

(22) STIEBELING, HAZEL K., and PHIPARD, ESTHER F.
1939. DIETS OF FAMILIES OF EMPLOYED WAGE EARNERS AND CLERICAL WORKERS IN CITIES. U. S. Dept. Agr. Cir. 507, 140 pp., illus.

(23) STIEBELING, HAZEL K., and WARD, MEDORA M.
1933. DIETS AT FOUR LEVELS OF NUTRITIVE CONTENT AND COST. U. S. Dept. Agr. Cir. 296, 58 pp., illus.

(24) STOUGHTON, AMANDA L., and MEAKER, VERNA T.
1931. DENTAL DECAY AND CORRECTION AMONG SCHOOL CHILDREN OF DIFFERENT AGES. U. S. Public Health Serv. Rpts. 46: 2608-2623, illus.

(25) Unpublished data from Nutrition Department of Hawaii Agr. Expt. Sta., Honolulu, U. S. A.

(26) WAUGH, DONALD B., and WAUGH, LEUMAN M.
1940. EFFECTS OF NATURAL AND REFINED SUGARS ON ORAL LACTOBACILLI AND CARIES AMONG PRIMITIVE ESKIMOS. Amer. Jour. Dis. Children 59: 483-489.

(27) WENTWORTH, EDNA C., and SIMPICH, FREDERICK, JR.
1936. LIVING STANDARDS OF FILIPINO FAMILIES ON AN HAWAIIAN SUGAR PLANTATION. Hawaii Group, American Council, Institute of Pacific Relations. 40 pp., illus. Honolulu.

(28) WEST, EDWARD S., and JUDY, FREDERICK R.
1938. DESTRUCTION OF TOOTH ENAMEL BY ACIDIFIED CANDIES. Jour. Dent. Res. 17: 499-504.

(29) WHITACRE, JESSIE.
1934. DENTAL DECAY AMONG TEXAS SCHOOL CHILDREN. Texas Agr. Expt. Sta. Bul. 491, 30 pp., illus.

(30) WISAN, J. M.
1941. AUTHENTIC DENTAL HEALTH INFORMATION FOR THE SCHOOL CHILD. Jour. Amer. Dent. Assoc. and Dent. Cosmos. 28: 401-403.

HAWAII AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF HAWAII

GREGG M. SINCLAIR, M.A. . . . . President of the University

JOHN H. BEAUMONT, Ph.D. . . . . Director of the Experiment Station

ADMINISTRATION: Louis A. Henke, M.S., Assistant Director——H. K. Hee, Administrator——Kathleen W. Pierson, B.A., Technical Administrative Assistant.

AGRONOMY: John C. Ripperton, M.S., Agronomist——Donald L. Van Horn, Ph.D., Assistant Agronomist——Edward Y. Hosaka, M.S., Assistant Agronomist ——Makoto Takahashi, M.S., Junior Agronomist.

ANIMAL HUSBANDRY: Louis A. Henke, M.S., Animal Husbandman——Elwin L. Willett, Ph.D., Associate Animal Husbandman——Charles I. Maruyama, B.S., Junior Animal Husbandman.

CHEMISTRY AND SOILS: Arthur S. Ayres, M.S., Assistant Chemist——Ruth K. Yoshida, M.A., Associate in Chemistry——Takuma Tanada, B.S., Assistant in Chemistry——Yoshinori Kanehiro, B.S., Assistant in Chemistry——Charles K. Fujimoto, B.S., Assistant in Chemistry——Nobuyuki Nakasone, B.S., Assistant in Chemistry——Harold A. Wadsworth, B.S., Collaborator.

ENTOMOLOGY: Frederick G. Holdaway, Ph.D., Entomologist——William C. Look, B.S., Associate in Entomology——Toshiyuki Nishida, B.S., Assistant in Entomology.

HORTICULTURE: John H. Beaumont, Ph.D., Horticulturist——David T. Fleming, Collaborator——William B. Storey, Ph.D., Associate Horticulturist——William Kirch, Junior Horticulturist——Warren S. Ikeda, B.S., Associate in Horticulture ——Lily Shaw, M.S., Associate in Horticulture.

NUTRITION: Carey D. Miller, M.S., Nutritionist——Eva Hartzler, M.S., Associate Nutritionist.

PARASITOLOGY: Joseph E. Alicata, Ph.D., Parasitologist.

PLANT PHYSIOLOGY: Harry F. Clements, Ph.D., Plant Physiologist——Ernest K. Akamine, M.S., Associate in Plant Physiology——Gordon T. Shigeura, B.S., Associate in Plant Physiology.

POULTRY HUSBANDRY: Carroll I. Draper, Ph.D., Associate Poultry Husbandman——James J. Teruya, Poultry Foreman.

TRUCK CROPS AND PLANT DISEASES: William A. Frazier, Ph.D., Horticulturist——John S. McFarlane, Ph.D., Assistant Horticulturist——J. Walter Hendrix, M.F., Assistant Plant Pathologist——Kazuo Kikuta, B.S., Associate in Plant Pathology——Minoru Matsuura, B.S., Associate in Plant Pathology——Samuel T. Tachibana, Assistant in Truck Crops.

BRANCH STATIONS AND FARMS: Robert K. Pahau, B.S., Agricultural Scientist, Kona Branch Station——Frank R. Mercado, Foreman, Poamoho Experimental Farm——Kazuo Murakami, Foreman, Haleakala Branch Station——Frank T. Murphy, B.S., Collaborator.